MEAN Temperature of the Surface of the Sea at Reikiavik.

Winter.	Spring.	Summer.	Autumn.	Year.
o 35·0 Fahr.	o 39·4 Fahr.	o 50·5 Fahr.	o 41·2 Fahr.	o 41·5 Fahr.

2. *On a Method for determining Longitude by means of Observations of the Moon's greatest Altitude.* By WILLIAM SPOTTISWOODE, M.A., F.R.S., F.R.G.S., &c.

THE object of the following Tables is the determination of longitude from a simple sextant observation of the moon's greatest altitude. Owing to her motion in declination, the moon's greatest altitude will always exceed her meridian altitude; and when the motion is sufficiently rapid, the former, which can always be made the subject of direct observation, may be used for determining the longitude. The Tables furnish the corrections required to be applied to the observed altitude in order to reduce it to the meridian altitude. The latter quantity and the latitude being known, the declination at meridian passage is also known; and the difference between this and the declination at her nearest Greenwich meridian passage will be the amount of declination gained or lost between the two meridians. The longitude being, as usual, supposed to be known approximately " by account," the rate of motion in declination can be taken out of the ' Nautical Almanac;' and the amount divided by the rate will give the true longitude in time.

The present method does not pretend to the same degree of accuracy as those of Jupiter's satellites, and of lunar distances; but the simplicity of both the observation and the calculation may render it useful for checking the dead-reckoning of a traveller whose last chronometer has broken down, either as supplementary to more elaborate processes, or as a substitute when they are not practicable.

The mathematical theory, upon which the present method is based, has been the subject of a communication to the Royal Astronomical Society, and is published *in extenso* in their Memoirs (vol. xxix., p. 343). It will therefore be sufficient here to subjoin the final formula from which the Tables have been calculated.

FORMULA.

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If D be the meridian declination sought,

    L   ,,   latitude,

    A   ,,   greatest altitude,

    Δ' ,,   difference of declination for 10 minutes, given in the Nautical Almanac,

$$m = 1{\cdot}04\frac{d\mathrm{D}}{dt},$$

then

$$\mathrm{D} = 90^\circ - (\mathrm{A} + \mathrm{L}) + \frac{m^2}{2}\frac{\cos \mathrm{A}}{\cos \mathrm{L} \sin (\mathrm{A} + \mathrm{L})}.$$

and the rule for using the Tables may be thus stated :—

$$\text{Meridian declination} = \text{difference between } 90^\circ \text{ and } (\mathrm{A} + \mathrm{L}) + \frac{\text{Corr. Table I.}}{\text{Corr. Table II.}}$$

EXAMPLE.—1860, June 25 d. 5 h. 30 m. Lat. 51° 45′ 36″ N. Long. by account 0. Apparent greatest altitude of ☽'s upper limb 33° 27′ 0″. Diff. of declination in 10 m., from 'Nautical Almanac,' 156″·7.

By ordinary methods (worked *accurately*),

		°	′	″
True alt. of ☽'s centre	..	33	58	39
L	..	51	45	36
A + L	..	85	44	15
		90		
		4	14	45
$\dfrac{\text{Corr. Table I.}}{\text{Corr. Table II.}} = \dfrac{54''}{1{\cdot}17} =$				46+
☽'s meridian decln. =		4	16	31
do. at 5 h. (Naut. Alm.)		4	5	29
662″ =			11	2

Elapsed time since 5 h. : 10 minutes :: 662″ : 156·7

$\dfrac{6620}{156{\cdot}7} = 42^{\mathrm{m}}{\cdot}25 = 42$ m. 15 s. Greenwich time of local meridian passage .. } 5 h. 42 m. 15 s.

Do. transit (Naut. Al.)	5	38	17
Longitude		3	58 W.

TABLE I.

TABLE I.—Part 1.

Alt.	LATITUDE.															
	70°	68°	66°	64°	62°	60°	58°	56°	54°	52°	50°	48°	46°	44°	42°	40°
80°																10″
78															13″	12
76														15″	15	14
74													18″	17	17	16
72												21″	20	19	19	17
70											24″	23	22	21	20	19
68										28″	26	25	24	22	22	20
66									32″	30	28	27	25	24	23	22
64								36″	34	32	30	28	27	25	25	23
62							41″	38	36	34	31	30	28	27	26	25
60						46″	43	40	38	35	33	31	30	28	28	26
58					52″	48	45	42	39	37	34	33	31	30	29	28
56				59″	54	50	47	43	41	38	36	34	33	31	31	29
54			67″	61	56	52	48	45	42	40	37	36	34	33	32	31
52		76″	69	63	58	53	50	46	44	41	39	37	36	34	34	32
50	86″	78	71	65	59	55	51	48	45	43	40	39	37	36	35	33
48	88	80	73	66	61	56	53	49	47	44	42	40	39	37	36	35
46	90	82	74	68	62	58	54	51	48	46	43	42	40	38	38	36
44	92	83	76	69	64	59	56	52	50	47	45	43	41	40	39	38
42	93	85	77	71	65	61	57	54	51	49	46	44	43	41	41	39
40	95	86	79	72	67	62	59	55	53	50	47	46	44	43	42	40
38	96	88	80	74	68	64	60	57	54	51	49	47	46	44	43	42
36	98	89	82	75	70	65	62	58	55	53	50	49	47	45	45	43
34	99	91	83	77	71	67	63	59	57	54	52	50	48	47	46	45
32	101	92	85	78	73	68	64	61	58	56	53	51	50	48	48	46
30	102	94	86	80	74	69	66	62	60	57	54	53	51	50	49	48
28	104	95	88	81	75	71	67	64	61	58	56	54	53	51	51	49
26	105	97	89	82	77	72	69	65	62	60	57	56	54	53	52	51
24	107	98	90	84	78	74	70	66	64	61	59	57	56	54	54	53
22	108	99	92	85	80	75	71	68	65	63	60	59	57	56	56	55
20	109	101	93	87	81	76	73	69	67	64	62	60	59	58	58	56
18	111	102	95	88	82	78	74	71	68	66	63	62	61	60	59	
16	112	104	96	89	84	79	76	72	70	67	65	64	63	61		
14	114	105	97	91	85	81	77	74	71	69	67	66	64			
12	115	106	99	92	87	82	79	75	73	71	69	67				
10	116	108	100	94	88	84	80	77	75	73	70					
8	118	109	102	95	90	85	82	79	77	74						
6	119	111	103	97	91	87	84	81	78							
4	121	112	105	98	93	89	86	82								
2	122	114	106	100	95	91	87									
0	124	115	107	101	96	92										

TABLE I.—Part 2.

Alt.	LATITUDE.				
	40°	30°	20°	10°	0°
80°	10″	9″	7″	7″	7″
70	19	16	14	14	15
60	26	23	21	22	23
50	33	30	29	30	
40	40	38	37		
30	48	46			
20	56				

TABLE II.—Divisors of Table I.

Arg. Diff. of Declin. for 10m. △″.							
△″	d.	△″	d.	△″	d.	△″	d.
5 0	11·6	8 0	4·51	11 0	2·39	14 0	1·47
1	11·2	1	4·40	1	2·35	1	1·45
2	10·8	2	4·30	2	2·31	2	1·43
3	10·4	3	4·20	3	2·27	3	1·41
4	10·0	4	4·10	4	2·23	4	1·39
5	9·6	5	4·00	5	2·19	5	1·37
6	9·2	6	3·91	6	2·15	6	1·35
7	8·9	7	3·82	7	2·11	7	1·33
8	8·6	8	3·73	8	2·07	8	1·31
9	8·3	9	3·65	9	2·04	9	1·29
6 0	8·0	9 0	3·57	12 0	2·01	15 0	1·28
1	7·7	1	3·49	1	1·97	1	1·26
2	7·4	2	3·41	2	1·94	2	1·25
3	7·2	3	3·34	3	1·91	3	1·23
4	7·0	4	3·27	4	1·88	4	1·21
5	6·8	5	3·20	5	1·85	5	1·20
6	6·6	6	3·13	6	1·82	6	1·18
7	6·4	7	3·07	7	1·79	7	1·17
8	6·2	8	3·01	8	1·76	8	1·15
9	6·0	9	2·95	9	1·73	9	1·14
7 0	5·9	10 0	2·89	13 0	1·71	16 0	1·13
1	5·7	1	2·83	1	1·68	1	1·11
2	5·6	2	2·77	2	1·65	2	1·10
3	5·4	3	2·72	3	1·62	3	1·08
4	5·3	4	2·67	4	1·60	4	1·07
5	5·1	5	2·62	5	1·58	5	1·06
6	4·9	6	2·57	6	1·55	6	1·04
7	4·8	7	2·52	7	1·53	7	1·03
8	4·7	8	2·47	8	1·51	8	1·02
9	4·6	9	2·43	9	1·49	9	1·01
8 0	4·5	11 0	2·39	14 0	1·47	17 0	1·00